SCIENCE.

FRIDAY, APRIL 1, 1887.

COMMENT AND CRITICISM.

THE *résumé* of the evidence concerning thought-transferrence which Dr. Morton Prince of the Boston city hospital drew up for presentation to a medical society, and which is now reprinted in pamphlet form, seems to us eminently judicious. It embodies such a judgment on this interesting but exceedingly difficult subject as an intelligent man who has carefully studied the evidence, and is competent to weigh it, may now fairly hold. Dr. Prince begins by hastily narrating the salient points in the history of the Society for psychical research, and then summarizes the Creery experiments, those with Messrs. Smith and Blackburn, and those carried on by Mr. Malcolm Guthrie, all of which are by this time familiar to American readers, an article recounting them having appeared in the *Popular science monthly* for August last. The evidence adduced by the above-named and similar experiments is, according to Dr. Prince, as follows: First, we have as experimenters a number of gentlemen noted for their integrity, and whose standing would exclude all intention at deceit on their own part. Second, the experimenters, after considerable previous experience, arrange the conditions of the experiments so as to exclude by every possible device all possibility of communication by the ordinary channels, including collusion. They are allowed to arrange the conditions according to their own option in such a way as to test in the most stringent manner the phenomena under investigation. In this way the experiments differ essentially from those made with ordinary professional spiritualists and mind-readers. Under these stringent conditions, results are obtained showing that the thoughts of one mind have been communicated in some way to another. Third, the experimenters conclude that the communication has been made by direct thought-transferrence.

Dr. Prince, in commenting on this summary of the evidence, says that the opinions of the experimenters themselves are of undoubted value, but that overlooked sources of fallacies may yet appear. The phenomena in question cannot be established beyond the possibility of a doubt until both observers and subjects have been very much multiplied. The opinions held by Dr. Prince himself as to the evidence seem to us amply justified by the facts. The opinions are these: 1°. All the evidence *that we possess, such as it is,* goes to prove that certain persons, under certain favorable conditions, can become cognizant of the thoughts of another without any communication by the senses; 2°. That the best *working* hypothesis that we possess is in favor of direct thought-transferrence as an explanation; 3°. *A priori,* there is nothing inherently impossible or improbable in the hypothesis; 4°. The subject must be considered as still *sub judice,* and needs further investigation to settle the question beyond possibility of doubt. Dr. Prince disposes very neatly of those critics who would set aside the evidence gathered in England because from time immemorial similar claims have been made by spiritualists, clairvoyants, and the like. He calls such objections illogical and unscientific, for there is not the slightest parallel between the two cases. "No physical experiments in the laboratory have been more under the control of the chemist and the physiologist than have these. The subjects have given themselves up to the experimenters, not occasionally and fitfully, but day after day. Any and every sort of condition has been cheerfully acquiesced in and imposed." Dr. Prince concludes his interesting paper by cautioning all persons against confounding the evidence for thought-transferrence with the muscle-reading of the professional 'mind-readers.' The more the intelligent public hears about thought-transferrence, the more it is convinced that a conclusion is going to be reached by a study of the evidence solely, and not by abuse and sarcasm aimed at the gentlemen who are giving their time, their labor, and their money to these investigations.

IN 1883 A COMMISSION was appointed in Germany to consider and report on the advantages and disadvantages of vaccination. In the commission were three anti-vaccinationists. The following are among the conclusions reached by the commis-

sion, whose report has recently been made. The length of time for which vaccination protects against small-pox varies greatly in different persons, but in the mean it is about ten years. 1°. Re-vaccination is necessary ten years after the primary operation; 2°. Two well-marked vesicles are necessary to insure a successful protective vaccination; 3°. There is no evidence as to any increasing special disease or of general mortality which can be considered as due to the introduction of vaccination; 4°. The use of animal vaccine is preferable; 5°. Vaccination should not be performed while scarlet-fever, measles, diphtheria, whooping-cough, typhus, or erysipelas are epidemic or unusually prevalent in the neighborhood: 6°. Infants should not be vaccinated before they are three months old unless small-pox is prevalent in the vicinity; 7°. The greatest care as to the cleanliness and disinfection of the instruments used for vaccination should be insisted on.

We heartily indorse most of these views and recommendations. The objection to vaccination during the prevalence of communicable diseases, with possibly the exception of erysipelas, is, we think, not a valid one. If any of these diseases exists in the family where there are children un protected from small-pox, vaccination should undoubtedly be deferred until the danger of contagion is passed. But in our large cities these diseases are so continuously present, that, if vaccination were to be postponed until they disappeared, we fear the operation would never be performed, and we should soon have a vast amount of susceptible material which would furnish a rich field for the propagation of small-pox. The admonition in reference to the care of the lancet is well-timed and important, and is a precaution which is too apt to be overlooked, both in private and public vaccination. Passing the lancet through an alcohol flame will accomplish the object in a perfectly satisfactory manner, or, if the vaccine-point is itself used to scarify, the danger is equally avoided.

Crudeli, as the result of a long observation of malaria in Italy, finds that while a certain amount of moisture is necessary for its development, yet it is by no means confined to swampy and low regions, but is often met with in elevated regions. In a recent discussion of this subject before the Boston society for medical observation, Dr. Bowditch reported a case of malaria which he believed to have developed in the Adirondacks. Dr. Folsom had observed that many cases occur in comparatively elevated localities, referring especially to an outbreak in a small town in the western part of Massachusetts, in which all the cases occurred on the top of a hill. It was his experience that persons might live for a time in a well-developed malarial region and remain free from the disease while there, and subsequently have the disease manifest itself after a year's residence in another place.

The subject of hypnotism, which has become so famous through the recent experiments of Charcot, engaged the attention of Dr. W. A. Hammond of New York some six years ago. At that time he hypnotized a young man in the presence of the members of the New York medico-legal society, causing him while in this condition to commit imaginary thefts and assaults. Dr. Hammond prefers the name 'syggignoscism' to that of 'hypnotism;' meaning the agreement of one mind with another mind, — a condition of automatism in which acts are performed without the conscious willing of the subject. Dr. Hammond finds that persons who are educated and are accustomed to direct others are not so easily rendered hypnotic as those who have always occupied subordinate positions. Mesmerism, so called, is closely allied to hypnotism. The theory of Mesmer was, that there was an inherent quality or power in the person operating, which accounted for the effects produced; whereas the peculiarity is in the subject, and any one can put such a subject into the hypnotized condition.

The problem of protecting from adulteration the food supply of large cities is one of increasing difficulty and complexity. For its successful solution it depends not only on energetic and intelligent inspectors but on the active support of public opinion. The recent report of Dr. Saunders, public analyst for the city of London, shows that in one case, at least, where the first of the above conditions is conspicuously present the second is conspicuously lacking. The report states that the public at large continues to show marked apathy toward the working of the food inspection laws, and that if the inspectors were not ordered to secure samples independently of complaints being made, no check would exist upon the adulteration of the foods and drugs sold in the city of London. During the year 1886 the department made one

hundred and eighty-eight analyses, of which sixty-one were of milk, twenty-two of whisky, nine of gin, sixteen of mustard, twenty-seven of drugs, ten of disinfectants, six of water, four of butter and butterine, and the remainder of miscellaneous articles. The discrepancies of opinion between analysts resulting from the employment of separate methods, and the unsatisfactory character of some of the laws relating to food supply, are given as reasons which have prevented the work of the department from impressing itself more firmly upon the community. The water supply of the city has maintained its high character during the year, the same freedom from organic impurity noted in previous reports having still existed.

IN A PRESIDENTIAL ADDRESS — now published as a magazine article — before the Society for the study of comparative psychology, Dr. T. Wesley Mills of McGill university said a great many interesting things about the objects and problems of that department of science which the society was founded to advance. Animals, he said, are the 'poor relations' of man: the latter is one of them not only in body but in mind. But poor relations though they are, yet "in not a few respects they are not only equal, but superior to man." Dr. Mills grants that it is not inconceivable that special faculties, not existent in the lower animals (we presume he uses the adjective 'lower' merely in deference to a custom of some antiquity) have been implanted in man, but the trend of investigation, he asserts, is to establish the fact that at least the germ of every human faculty does exist in some species of animal. Brutes reason, says the writer. They can and do form abstract conceptions. They have, furthermore, a moral nature, and are capable of forming a conception of right and wrong. Man has only developed a superiority to the brute because of "his social tendencies, resulting in the division of labor, with its consequent development of special aptitudes, and its outcome in the enormous amount of force which he can, on occasion, bring to bear against the various tendencies making for his destruction."

Now, before Dr. Mills puts forward any such conclusions as these, or goes to work with the method and premises he has assumed, he must first establish the legitimacy of that method and those premises. And to do this he must, we fancy, meet the argument of Prof. C. Lloyd Morgan on the subject of the study of animal intelligence. That he has not faced this argument is evidenced by his naïve and apparently conclusive question, "Since from experiments on the brains of the lower animals we argue as to the nature of the brain of man, why may we not pursue the comparative method for the soul?" Perhaps we may; but it must be done under such limitations, and in the light of such considerations, as Professor Morgan has indicated. The first and most fundamental of these is, that, while we are justified in believing in the existence of intelligence or mind in animals, it must be steadily borne in mind that this has to be interpreted not only by human consciousness, but *in terms of it*. Again, in all the stories related of the intelligence, morality, and so forth, of animals, there are two distinct elements, — first, certain actions performed under certain external circumstances, which may be called facts; and, secondly, certain inferences which are drawn from the facts. These inferences must be rigidly excluded from the class of facts; and, when so excluded, that portion of them which is ejective must be treated as such, and not as objective. These limitations and considerations carry with them many consequences, but we can find in Dr. Mill's address no evidence that he has ever given them any consideration.

THE BEST METHODS for the disposal of garbage must necessarily differ according to circumstances. For some communities its utilization in the feeding of swine is a practical solution of the problem; while for others no better way seems to have been devised than to deposit it at sea, so far from land as to preclude the possibility of its return by wind or tide. Still another plan is that of its destruction by fire or cremation, — a plan which theoretically is perhaps the most satisfactory from a sanitary stand-point, but one in regard to which practically there seem to be so many difficulties as thus far to have prevented its adoption in the largest cities of the United States. This problem is now being discussed at Milwaukee, Wis. One proposition is to take the garbage to the country and then feed it to animals, another is to deposit it in the waters of the lake, and a third to consume it by fire. A company proposes to erect two cremators, at an expense of ten thousand dollars, for this purpose, claiming that the running expenses will not exceed $15.50 per diem

DURING THE PAST WINTER, which was an unusually severe one at sea, the fish commission succeeded in hatching thirty-five million cod-eggs, bringing the young up by hand, so to speak, to the age of self-feeding adolescence, and turning them loose into the ocean. This crop will be 'ripe' four or five years hence. The fish commission will also attempt to repeople our coastal waters with halibut, the supply of this valuable food-fish having been depleted in waters where it was once common. The attempt will probably be first made to plant the halibut in Chesapeake Bay. Advices just received from New Zealand state that a million and a half white-fish ova, sent by Professor Baird from Northville, Mich., last December, to Sir Julius Vogel of New Zealand, arrived there in January in excellent condition, only five hundred having died.

CRUELTY OF OLD CUSTOMS.

WE have several times referred to the case of Rukmibhai, the native lady whose wrongs aroused so general a feeling of sympathy in England and India; but, as the case now appears to be on the point of reaching a crisis, it may be well to recapitulate the facts briefly, as given by the Calcutta correspondent of the London *Times*. Rukmibhai was married, according to Hindoo usage, at the age of eleven, to a youth some years her senior. She remained at her parents' house, was carefully educated, and grew up, according to all accounts, into a refined and highly cultivated lady. Some eighteen months ago she published in the *Times of India*, under the *nom de plume* of 'A Hindoo lady,' a series of forcible and striking letters on the miseries entailed on her sex in India by the barbarous customs of infant-marriage and enforced widowhood. Last year her husband tried to get her to live with him, and, on her refusing, instituted a suit for the restitution of conjugal rights, in the Bombay high court. The case was tried in the first instance by Mr. Justice Pinhey, when, it having been proved that the husband was too poor to support her, was utterly ignorant and uneducated, — in fact, a mere coolie, — and was, moreover, consumptive, the judge expressed the opinion that it would be a barbarous, cruel, and revolting thing to compel her to live with such a man. He further held that such suit could not lie under Hindoo law, and dismissed it.

The husband appealed, and the case was argued before the chief justice and Mr. Justice Bayley. Those learned judges, while expressing their entire sympathy with Rukmibhai, felt compelled to rule that Mr. Justice Pinhey was wrong in law, and remanded the case to the lower court for trial on its merits. It has now been reheard before Mr. Justice Farran. Rukmibhai's counsel could only repeat that his client had never consented to the marriage, and never regarded the man as her husband; that the husband was poor, ignorant, and unhealthy; and that if ordered to return to him she would be forced to disobey, and was prepared to take the consequences. The court had no option save to pass an order that she should join her husband within a month. Should she fail to do so, she would be liable to six months' imprisonment. The case has excited much sympathy among the Anglo-Indian community. The English newspapers are publishing articles and letters on the subject, and steps are being taken in Bombay to raise a fund on her behalf. Among the native community, however, hardly a single voice, except that of Mr. Malabari, a Parsee gentleman, has been raised in her favor, and the so-called reformers who agitate loudly for representative institutions, etc., say no word for the alteration of the cruel law which the Bombay court has been reluctantly compelled to enforce.

Upon this case the *Times* comments as follows: "There can be no doubt to which side opinion in this country will incline. Our correspondent tells us a tale of monstrous wrong and of injustice in the disguise of law. But the disguise, unfortunately, is impenetrable. The law is the law, and in the view of Rukmibhai's fellow-countrymen there is nothing shocking or revolting in the end which it has been employed to serve. The Hindoo marriage-law can claim, with justice, to have the sanction of immemorial usage. Whether it is based or not on a correct interpretation of the sacred books, — and there is room for grave doubt on this point, — it has prevailed for some thirty centuries, and it is closely interwoven with the moral and religious sentiments of the people. Religion pronounces that every Hindoo girl must be married. The parent who has an unmarried daughter of full age in his house is not only an offender against social usage, but is guilty of a religious crime, threatened with puishment in a future state, and one which his outraged neighbors will not be satisfied to leave to its deferred theological sanction. The father would be a degraded man. His daughter, therefore, must be married to some one, and if no fit person is forthcoming, she must be joined to some unfit person, and this at the earliest age possible, so as to settle the matter and make things safe for the father. Rukmibhai has been treated with somewhat exceptional favor in having had her marriage ceremony put off until she was eleven years of age. Many

Hindoo girls are married much earlier, in their seventh or eighth year, and once married, there is no escape possible for them. Wifedom may be a revolting servitude, but widowhood is a living death. The widow is an outcast, with no civil rights and no social standing. Her proper place would have been on her husband's funeral pile, but since suttee has been forbidden, a fate more cruel, an agony more prolonged, has been the appointed lot of the woman who survives her lord. Now, whatever we may think of this system, it is quite certain that it commends itself to Hindoo feeling. So strong is the sentiment in favor of it that Lord Dufferin has not ventured to attempt a change in the law. He has sounded native opinion on the subject; he has consulted the local administrations, and the replies he has received have been unanimous against any legislative interference. Rukmibhai is, therefore, a wife in the eye of the law, and a wife she must remain.

"The present feeling of the Hindoo community in favor of the existing marriage-law has been signified in a variety of ways. When there was talk of the possibility that the government might interfere to change the law, a large meeting was held at Bombay to protest against such a course. It was not unanimous, but the voice of the majority was given, not only against a compulsory change in the law, but in support of the law, which they cherished as being of social and religious importance. The daily conduct of the people is in agreement with this declaration. They inflict the social penalties which are the main sanction of the law, and without which the law would speedily fall into disuse. But as long as there is a minority of dissentients, social penalties are not very dreadful to those who can dare to face them. The meeting at Bombay shows us only what the men think, and it shows us that even they are not entirely of one mind. It tells us nothing about the women. We know from Rukmibhai's case that there is one woman, at least, who has cut herself free from the superstitions and prejudices of her country. As education spreads, and as the medical missions to women begin to bear the full fruit which we may expect from them, the number of the emancipated will grow. Hindoo women will learn the rights of their sex elsewhere, and will demand a share in them for themselves. It is the women who suffer under the present Hindoo marriage-law, and it is from one of their number that the first act of open rebellion has come. We trust that the example will be of service towards a general enfranchisement of the sex. When the day comes at which the women refuse to be bound by the tyrannical rule imposed upon them, the men may resolve as they will, but they will be forced to yield nevertheless; and we are quite sure that the sacred books will be found quite elastic enough to justify both parties, the rebels and the consenters to the rebellion. The process of change may be slow. The customs of thirty centuries are not to be uprooted at a stroke. It will be enough if there is some progress made. If Rukmibhai finds even a few who will support her in her stand, she will have dealt no light blow at the law which has driven her to revolt."

PARIS LETTER.

THE sugar-beet industry in northern Germany is in great apprehension, owing to the destructive effects of a newly described parasite, a nematoid worm, which, according to M. A. Girard's recent paper read before the Academy of sciences, is doing great damage in the beet-fields. This worm is found at the end of the roots, in the so-called 'suckers' of the smaller radicules, and uses for its own benefit all the alimentary matters absorbed by the roots. The consequence is, that the plant soon withers and dies. But not so the animal. It is ploughed out of ground to be swallowed by any chance animal. It is finally expelled, in good order, perhaps in a beet-field, where it immediately begins again its depredations. No method is yet known for the destruction of this parasite. It is, however, of some value to know how it lives.

An interesting paper on therapeutics has been published by M. Jacobelli, who is trying to cure pulmonary tuberculosis by means of inhalation of caustic vapors, believing they will cause the ulcers on the lungs to heal. No good results have yet been detected, and it does not seem likely that any will be obtained. Unless the vapors kill the bacillus, there does not seem to be any possibility of a useful influence. Tuberculosis is the result of the presence of the bacillus; and so long as this microbe remains in the body, tubercular symptoms must be present. As the old saying goes, '*Sublata causa, tollitur effectus*,' and in this case it is not the cause, but a symptom only, that, very uselessly it seems, is being combated.

The French government has recently obtained from Greece permission to prosecute archeological investigations in what remains of Delphi. This city was, except Olympia, the most important sanctuary of ancient Greece, and it contained an abundance of art-specimens, which made it quite a magnificent gallery. It is generally believed that the remains of the temple of Delphi, at present covered by a small fort, contain many specimens of great interest for archeology and art. The American government petitioned for

the same privilege, but was forestalled by the French delegates, owing to the perseverance of MM. de Mouy and de Montholon. Whether French or American workers do the work, matters little: the essential thing is, that it be well done and profitable to archeology.

A recent paper read at a meeting of the Biological society spoke at length of the possibility of obtaining glass or crystal lenses thick enough to resist a pressure of a thousand atmospheres. In order to study *de visu* the influence exerted on animals by high pressures, it was desired to fix in an iron or steel apparatus a lens allowing a constant supervision of what was going on inside. Quartz was first used, but it could not withstand more than four or five hundred atmospheres. Then glass was used, and also a different manner of securing it. The results were very good. By means of the leather half-cylinder used in hydraulic presses, the glass lens was very well held and made fast, and the lens itself (fifteen millimetres thick and forty in diameter) supported a pressure of a thousand atmospheres without the slightest inconvenience.

The first two numbers of the *Annales de l'institut Pasteur* have been published, under Professor Duclaux's direction. They contain much good material. In the first number there is an interesting letter from Pasteur, concerning antirabic inoculations in general. The second number contains a paper by M. Roux on culture-methods for antirabic microbes, which will be of use to many. Dr. Gamaleïa has contributed a long and very interesting paper on paralytic rabies, showing that this form of the disease, considered uncommon, and believed by M. Peter to result only from experimental rabies, is in fact common, and has been frequently met with by himself and others.

The vine-growers of Algeria are now seriously troubled by the destruction caused in their vineyards by an insect, Altica ampelophaga, which threatens to become a curse, very troublesome, but less dangerous than phylloxera has been to continental vineyards. This insect is becoming very numerous, and its effects are considerable already. In some places more than a third part of the whole production is destroyed by it. It feeds on grape-vine leaves only, eating them as fast as they appear, and ultimately killing the vine. As it is a very prolific insect, giving over five generations in a single summer, much is to be feared from it. During the winter it hides in recesses under the bark of trees, under dead leaves, in the earth, etc. Many methods have been tested to destroy it, but those that are good cost too much. This plague has been long known in Spain. In mediaeval times public prayers were ordered in Andalusia when the insects became too numerous. It is unnecessary to say that no results whatever were noticed, and even Catholic Spain now deems it better policy to try and fight the plague without asking for supernatural aid.

At a recent meeting of the Biological society, M. Ch. Ozanam presented a paper on the use of carbonic acid as an anaesthetic. The carbonic acid, mixed with air, is inhaled. The anaesthesia so induced is a very complete one, without danger, and may last a long time. M. Ozanam has used this method in operations on man, and is quite satisfied with the result. These facts have been confirmed by M. Grihant. It must be noticed that the anaesthetic properties of carbonic acid have long been known. Carbonic acid was most likely the first anaesthetic used, as it has been surmised that the anaesthesia induced by the physicians of ancient Egypt and Greece was due to the carbonic acid evolved by the contact of vinegar and marble.

M. E. Bérillon has recently published an excellent little book giving an accurate account of Paul Bert's work in physiology. It is equally readable for scientists and the general public. The principal results of M. Bert's work in the various branches of physiology are analyzed and explained in a very clear and correct manner, and a list of his principal contributions is appended.

A new medical paper has just been started by Professor Grancher of the Paris medical school. It is the *Bulletin medical*, and is expected to prove a success. Medical papers are generally of little value in France, save, of course, those which contain only original matter. The papers intended to keep practitioners well posted upon the progress of medical science are very incomplete. None can compare with the *Lancet* or *British medical journal*, or with the best American papers. Many of them are worth nothing, and it is a wonder they contrive to live. The *Bulletin medical* has correspondents abroad in great number, and contains a great deal of matter in the shape of original contributions, chemical lectures, reviews of books and scientific papers, society transactions, etc. It is published twice a week. V.

Paris, March 9.

GEOGRAPHICAL NOTES.

Asia.

The Russians and the English are equally earnestly engaged in exploring central Asia. Mr. A. D. Carey of the Bombay civil service is now making a journey of considerable interest. *Nature* says, "Mr. Carey left India in May, 1885, and

marched through Ladak into northern Tibet (Chángtán) as far as the Mangtsa Lake, and then struck northward, descending on the plain of Turkestan, near Kiria. He thus traversed over three hundred miles of country which had never before been visited by a European. The altitudes on this section of the journey were always very great, the track running usually at about sixteen thousand feet above the sea, while one, at least, of the passes crossed, was calculated to reach nineteen thousand feet. After a stay at Kiria and Khotan, the Khotan River was followed to its junction with the Tarim ; the route then lay along the latter river to Sarik, and then across a stretch of desert to Sháh-Yarand Kuchár. From the latter place the Tarim was followed down to a point where it turns southward towards Lake Lob. From this point the towns of Kurla and Kárástaber were visited, and about the end of the year the Tarim was struck again and tracked down to Lob-Nor. Thus the whole length of the Tarim has been explored. The country along its banks is described as flat and reedy, and the people extremely poor and miserable. Mr. Carey pitched his camp at the village of Cháklik, some distance south of the lake, and close to the foot of the great range of mountains which forms the northern scarp of the Tibetan highlands. On April 30, 1886, Mr. Carey started from this village on a journey southward into Tibet, over a pass in the Altyn Tagh range, and onward by a track occasionally used by the Kalmucks. Since this start, nothing has been heard of Mr. Carey, but it is presumed, that, after spending the summer and autumn in travelling over the elevated region, he has returned to Turkestan to winter."

Africa.

Stanley's expedition arrived at the mouth of the Kongo on March 18. According to *Nature*, Stanley, on his arrival at Stanley Falls with the first contingent of his expedition, about 250 men, will proceed at once to Emin Pasha, without waiting for the rest of his party. No doubt he will be re-enforced by some of Tippo's men. The main body will follow as soon as the steamers are able to land them all at Stanley Falls, but first a camp will be established, at some distance from the Falls, as a base of operations.

The reports published by the Kongo association on the state of affairs on the upper Kongo are a strong contrast with letters published by the Paris geographical society. Some details on the loss of the Stanley Falls station are given, and the fear is expressed that the Arabs might attack the Bangalla station. Besides, the intercourse on both shores of Stanley Pool is said to be interrupted by the natives attacking the caravans. It is probable that Stanley's negotations with Tippo-Tip may lead to the establishment of friendly relations between the Arabs and the Kongo Free State. The latest news says that Tippo-Tip is to be appointed chief of the Stanley Falls station.

Lieutenant Baert, who explored the Mongalla, states that at the farthest point reached by him it is only thirty feet wide and four or five feet deep. This place is very near Junker's Ali-Kobo, on the Welle. Baert's statement shows plainly that the Mongalla is not the lower course of any one of the rivers the sources of which were explored by Junker, but that its drainage area is a small one.

Dr. Zintgraff, who visited West Africa a few years ago, has been commissioned by the German government to explore the river system of the Cameroon districts in the little steamer Nachtigal. He intends to visit the Cameroon Mountains. As large quantities of caoutchouc are said to be obtained there, he will be accompanied by an expert in that material.

America.

It must be regretted that congress failed to appropriate the money demanded for a survey of the boundaries between Alaska and the British possessions, and between the south-western territories and Mexico. Besides its being desirable from a scientific point of view, it is practically of great importance. The discovery of rich gold-deposits near the boundary between British Columbia and Alaska may furnish grounds for another quarrel between the United States and Canada. The boundary, as defined by the treaty with Russia, follows the summit of the mountains situated parallel to the coast as far as longitude 141° west, and is in no place more than thirty nautical miles from the coast-line. Of course, this definition is very vague, and disputes between American and Canadian miners may be expected if the survey is not soon undertaken.

Polar regions.

Mr. A. McArthur's prospects of being successful in his enterprise of reaching the north pole are not very promising. He left Winnipeg only a few weeks ago on the way to Hudson Bay. A few days ago his companion returned to Winnipeg, having left him to go on alone. Nevertheless, McArthur may do good scientific work in Hudson Bay, if he resolves to confine himself to researches in that region.

According to the *Dagblad* of Copenhagen, the population of northern Greenland, about the end of 1885, was 4,414 (2,119 males and 2,295 females);

that of southern Greenland, 5,500 (2,557 males and 2,943 females). The increase of population in 1885 was 86 in the northern and 31 in the southern part. The slow but steady increase forms a favorable contrast to the rapid decrease in the English and American parts of arctic America. The Danish government takes care of the natives, who fully repay the outlay of the government by the produce of their hunting and fisheries. The English and Americans, though they claim the country, leave them to the mercy of whalers and traders, whose disastrous influence will destroy them within a short time.

The whalers who annually visit Baffin Bay state that the enormous mass of land-ice which, in 1884, extended from the shore of Baffin Land to a distance of about sixty miles, did not give way until the summer of 1886. The ships were unable to approach the coast from Cape Bowen to Cape Searle for three years. After the ice had broken up, whales were found in great numbers in Cumberland Sound and near Cape Mercy, while in the previous years hardly any were met with on these grounds.

NOTES AND NEWS.

THE U. S. coast survey lost one of its most capable assistants recently by the death of Mr. Carlisle Terry, jun., who died at his home in Columbus, Ga. Mr. Terry was a young man of great promise, and his work on the Pacific coast during the past winter had been most successful, being highly commended by the authorities at Washington.

— A halibut weighing thirty-four pounds and measuring forty-one inches in length was captured recently in the lower Potomac, near Colonial Beach. This is the first authentic case of a halibut in fresh water. Hitherto it was supposed that the vicinity of Long Island was the extreme southern limit of the habitat of this fish. The specimen caught in the Potomac has been preserved in alcohol by the Smithsonian institution, and a cast has been made and placed on exhibition in the national museum.

— Three fine specimens of carp have been caught in a net in the lower Potomac, one weighing over seven pounds. The fish commission have preserved these fish in their large aquaria at Washington. Several white-fish and bass were also taken in the same locality. These are evidences of the good results attained by the U. S. fish commission in the propagation of food-fishes.

— The gem-collection in the national museum has just been enriched by the addition of the pearls and diamonds given to President Van Buren by the Imaum of Muscat. These valuable jewels have been lying in the vaults of the treasury for nearly forty years, and were previously on exhibition in the patent office; but some of them were abstracted, and they were placed in the treasury vaults. There are one hundred and fifty pearls and one hundred and six diamonds, the latter aggregating twenty-one carats in weight.

— Prof. C. V. Riley, the entomologist of the agricultural department, has gone to California to investigate various matters which have been demanding the attention of his bureau for some time. His special mission is to investigate the Coltony cushion scale, an insect imported from Australia, which is doing immense damage to the citrus-orchards of California.

— The new naval observatory, for which congress appropriated $400,000 several years ago, is to be built in the near future. Mr. Richard M. Hunt of New York has been appointed architect of the building. Contracts for the work on the observatory will be made, and the building operations will shortly begin.

— The second spring meeting of the Indiana academy of sciences will be held on May 19 and 20, 1887, at the 'Shades of Death,' near Waveland, Montgomery county, Ind. This place is situated on the banks of Sugar Creek, which here passes through a deep gorge cut in the subcarboniferous sandstone.

— The Marine laboratory of the Johns Hopkins university has been opened at Nassau, New Providence, West Indies, under the direction of Dr. W. K. Brooks.

— The Harvard natural history society, having for a number of years been in a particularly dormant state, has recently, by the energetic work of its president, Mr. Nolan, sprung into life again. Under its auspices there will be a series of weekly lectures, or rather talks, at the society's rooms, upon the local fauna and flora. The first of the course is announced for March 30, to be delivered by Mr. Samuel Garman, upon the reptiles of Massachusetts. Other talks will follow, on the Wednesday evening of each week, by Mr. S. H. Scudder on butterflies, Dr. J. S. Kingsley on crustacea, Mr. James Emerton on Spiders, Mr. William Brewster on birds, and others not yet announced.

— Mr. William H. Dall of the Smithsonian institution has just returned from a trip to Florida, embracing a trip up the Caloosahachee River, where he went in search of fossils. His trip was most successful. This deposit was first discovered

two years ago, and the first visit to the fossil region was made last year by Professor Heilprin and Mr. Wilcox of Philadelphia. About half of this immense deposit is of an almost extinct class, and the remainder is of similar material to that found farther south, notably in the West Indies. Mr. Dall considers this fossil deposit the finest yet found in the United States. On Little Saratoga Bay a rock was found in which there were fragments of Indian pottery of rude workmanship, showing that the occupation of Florida dates back into the earlier ages.

— The U. S. coast survey is about to begin operations in the field, after a suspension of six months. The following work has thus far been mapped out by the superintendent. The geodetic leveiling party, consisting of Assistants J. B. Weir, J. E. McGrath, and W. B. Fairfield, have suspended work in Mississippi and Alabama, the appropriation for its continuance being exhausted, and have returned to Washington. This party will take the field again in New York, and will run a line of precise spirit levels around the main harbor of New York, connecting all the benchmarks and tidal stations with this line of levels, and with the New York end of the transcontinental line. This line will also be connected with the line of levels which extends up the Hudson River from New York to Albany. A detailed hydrographic survey of a portion of Baltimore harbor will be commenced on the 1st of April by Assistants W. J. Vinal and E. L. Taney, under the immediate supervision of the engineer, N. H. Hutton, of the Baltimore harbor board. All the parties on the Pacific coast have received instructions to take the field, the appropriations being in such condition that the work will probably be carried on continuously from May 1 to Dec. 1. The telegraphic longitude parties in charge of Assistants Edwin Smith and C. H. Sinclair are instructed to take the field between April 1 and 20. Their first work will be the connection of Davidson's observatory, San Francisco, with Salt Lake City. This promises an important link in the longitude determinations of the Transit of Venus station near Fort Selden in New Mexico. The topographical and triangulation parties will take the field on the coast of Maine about the first of May, or earlier if the season permits. Three or four topographical parties on the north side of Long Island Sound are expected to fill in the few gaps in the topography that now exist between the shore-line and the New York, New Haven, and Hartford railroad. Assistant J. F. Pratt and Sub-assistant Fremont Morse have been instructed to make a preliminary topographical reconnaissance of Washington Territory on the Pacific coast. A survey of this uninhabited, unapproachable, and almost unknown portion of the Pacific coast is greatly needed.

— There are sixty candidates for the fellowship of the Royal society this year, about the average number for the last four or five years. The council will in April select fifteen of these for recommendation to the society, and the election will take place on the 9th of June.

— The next session of the National academy of sciences will be held in Washington, D.C., beginning Tuesday, April 19, 1887, at 11 A.M.

— Dr. R. N. Cust, well known for his valuable linguistic and ethnological treatises, and particularly for his works on the 'Modern languages of the East Indies' and the 'Modern languages of Africa,' is preparing a similar work on the 'Modern languages of Oceania.'

— A reproduction of part of the map in the first bulletin issued by the New England meteorological society was given in *Science* for Jan. 2, 1885. Thirty-six observers then contributed to the society's records. The number is now a hundred and fifty.

— For five years the Brookville, Ind., society of natural history have given a course of free popular lectures. The course this year has thus far been the most popular of the series. The following lectures have been given this winter: Oct. 15, 'The study of man,' by D. G. Brinton; Nov. 26, 'The intelligence of instinct,' by J. P. D. John; Dec. 17, 'World-building,' by George M. Maxwell; Jan. 14, 'The study of mythology,' by L. H. Thomas; Feb. 4, 'Three weeks without water,' by H. W. Wiley. The following lectures are yet to be given: March 11, 'Life among the Japanese,' by T. C. Mendenhall; April 1, 'Our national park,' by J. M. Coulter; April 29, 'Agassiz,' by D. S. Jordan.

— Dr. Peale has brought together in his paper on the mineral springs of the United States, (Bull. U. S. geol. surv., No. 32, Washington) an immense amount of information about the mineral springs of this country. The list was formed primarily to aid in the statement of the commercial value of mineral waters as part of the mineral resources of the United States; but it will have a much wider usefulness than that would imply. It is small praise to say that this list is the most comprehensive that has yet been issued. The most complete before this, that of the American medical association, mentions about five hundred localities; while Dr. Peale has collected data as to 2,822 localities, including more than 8,000 springs. Even this is necessarily an imperfect enumeration, and must be regarded as 'preliminary to more de-

tailed work.' In addition, the list contains analyses of more than 800 springs, and, wherever possible, the temperature, volume, and character of each spring are given. Only those who have done similar work can appreciate the amount of thankless drudgery involved in this useful paper.

LETTERS TO THE EDITOR.

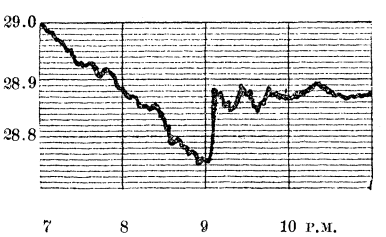
**** The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Barometer exposure.

About noon of Feb. 18 the barometer at Blue Hill observatory began to fall rapidly, and continued to do so until about 9 P.M. During this fall the wind steadily increased in velocity, and between 8 and 9 P.M. was blowing almost a hurricane. Immediately after 9 P.M. the hurricane-like roar of the wind suddenly ceased. Glancing up at the observatory barograph, I saw that it was rapidly rising, and within two or three minutes had risen more than a tenth of an inch. The barograph is of the Draper pattern, and multiplies three times. The accompanying diagram is a copy of the part of the barograph trace on Feb. 18, showing the rapid rise in pressure referred



to. There was thunder and lightning for about an hour preceding and following this sudden rise.

The following are the wind-velocities in miles per hour for each five minutes as obtained from a Hahl anemograph: —

Time (P.M.)	8.30	8.35	8.40	8.45	8.50	8.55	9.00	9.05	9.10	9.15	9.20	9.25	9.30	9.35	9.40	9.45	9.50
Velocities (miles)	65	60	64	69	71	69	65	31	36	48	35	15	18	30	37	36	33

After 9.50 the velocity varied but little for several hours. It is seen that between 9 and 9.05 P.M. there was a sudden decrease in the wind-velocity of about 35 miles, coinciding with the sudden rise in pressure; and, furthermore, each of the less-marked fluctuations of the barograph curve following this is connected inversely with corresponding variations in the wind's velocity.

The change in wind-velocity was evidently connected with the rise of the barograph at 9 P.M.; and the question presents itself, Was the rise of the barograph evidence of an actual existing difference of pressure in the atmosphere, or was it a merely mechanical effect of the wind sucking the air out of buildings while the wind-velocity was high, and allowing it to flow in again as the wind-velocity decreased?

From what we know of the connection of wind-velocities with barometric gradients, it would be anticipated that such a difference of pressure in the atmosphere as would cause a rise of the barometer at any point to the extent of a tenth of an inch in a minute or two, would give rise to an enormous increase in wind-velocity. But, instead of finding the increased wind-velocity with the rise of pressure, there was just the opposite: hence the inference is, that the rise of the barograph was due to the decreased wind-velocity relieving the stress on the air in the building.

On examining the barograph trace obtained by Professor Davis at the Harvard laboratory, ten miles north of Blue Hill, it is found that an almost identical and equal jump of the barograph curve occurred within a few minutes of the rise at Blue Hill; so that, whatever the origin of the rise, it was evidently due to some general cause acting similarly over a comparatively large area.

The observations of the signal service taken all over the United States at 10 P.M. show that there existed at that time a large cyclonic storm central-north of Lake Superior. The circulation of the wind, as well as the bending of the isobars, also give undoubted evidence of the existence, at the same time, of a small secondary over New England.

An explanation of the sudden decrease of wind-velocity hence suggests itself. Previous to 9 P.M. the vicinity of Boston was on the outer edge of the secondary, where the isobars were greatly crowded and the wind-velocity high; but at 9 P.M. it suddenly entered the progressing central area of the secondary, where the pressure was more uniform, and the wind-velocity immediately decreased. This explanation necessarily involves the assumption that the pressure in the vicinity of Boston was lower after 9 P.M. than preceding it, and the apparent rise was merely a subjective effect due to the wind. No other assumption seems to me reasonable, especially when we find at 10 P.M. the wind over a small area circulating around and centring in toward southern New England.

H. Helm Clayton.

Blue Hill meteor. observ., March 25.

On certain electrical phenomena.

I hasten to acknowledge that I unintentionally misrepresented Dr. Shufeldt in one sentence of my letter in *Science*, No. 213. I was wrong in affirming that he stated that he had never observed such exhibitions in Washington; for what he really said was, that he had never observed them as far as his own person was concerned.

I hope Dr. Shufeldt will be equally ready to admit that he has misrepresented me in his reply to my remarks (*Science*, No. 216), where he has omitted the essential part of one of my sentences, and altered the remaining part, even going so far as to include the 'mangled remains' in quotation-marks. Any one who will take the trouble to examine my first letter will see that what I really advised him to do was to *critically examine* his facts, "possibly eliminating a

few of them," etc. Everybody will understand the meaning of the sentence, which was, that a close examination of what he had assumed to be facts might lead to the rejection of a part thereof.

But it is also perfectly plain that all of this has really no bearing on the point at issue. It is always easy to quibble about words and phrases, while it is not always easy to avoid error in observation or erroneous deductions from correct observations.

If Dr. Shufeldt's observations and conclusions are correct, they are of the highest importance, and they must be subjected to the most searching examination before acceptance. I must still confess that there is much that is mysterious to me in his account of his sensations and observations. I do not understand what he means by saying, "My entire system seems to become thoroughly charged with this animal electricity." His "sense of the most profound relief," etc., in the case of the mulatto girl, is a mystery to me. His inability to use any other than a rubber penholder, and the statement that "even then the constant passage of the electricity is exceedingly exhausting during most of the time," are hard nuts for me to crack. In short, the whole matter hinges upon the question with which my first letter closed, — "Is man one of the extremely small number of animals having specialized electrical organs?" for only in that case is the expression 'animal electricity' properly applicable. In that letter I gave reasons for the belief that all such phenomena, the existence of which was certainly established, were nothing more than cases of accidental electrification by well-known methods and under long-recognized conditions; that under similar conditions no differences among individuals could exist; that such electrifications had been known for a long time, and that no extension of well-established principles was needed for their explanation.

To this statement nothing need be added until Dr. Shufeldt, or some one else, shows that it is insufficient to account for observed facts.

T. C. M.

Terre Haute, March 27.

A sensitive wind-vane.

In the last number of *Science*, under 'A sensitive wind-vane,' the statement 'The notation is the same as,' etc., should be 'The notation is opposite that,' etc.

H. ALLEN.

Washington, D.C., March 25.

As suggested by Mr. Allen in his interesting letter in *Science*, No. 216, it is important first to determine what is meant by a sensitive vane, and still more important, in my judgment, to determine what kind of a vane is wanted in meteorological observations. I have experimented a good deal with both the long, heavy vanes, and those which are short and light. Neither variety, as ordinarily constructed, is satisfactory. I have more than once seen two large 'standard' vanes, on the roof of the office of the chief signal officer in Washington, sullenly staring each other in the face, while a very light breeze held a short and very light vane nearly at right angles to both of them. Such performances are confusing, to say the least. But it seems to me not impossible to have one vane which shall satisfy all the requirements. The desired conditions are to be met with in what is known as the *dead beat* galvanometer. In this, the needle under the action of a steady current, whether strong or feeble, moves to its proper position, does not go beyond it, and does not vibrate about it. This is brought about by making use of a force opposing the movement of the needle, which increases with the angular velocity of the needle, and is zero when the needle is at rest. Something of the same kind ought to be accomplished, and I think may be, for the wind-vane. The force opposing the motion of the vane should increase with its velocity, and *should be zero when the vane is at rest.* If the latter condition is strictly satisfied, it will be infinitely sensitive: the slightest breeze will move it, but the opposing force will prevent violent oscillations. Such a vane will be somewhat slow in its movements, and may not respond to extremely rapid fluctuations in the direction of the wind, through only a few degrees; but I do not believe meteorologists will consider this a serious objection. What is wanted is a vane which will be steady in a high and somewhat varying wind, and which can be controlled by the slightest movement of the atmosphere. About two years ago I suggested what appeared to me to be a solution of the problem. It was to use a small and extremely light vane, so as to reduce ordinary friction to the lowest limit, and then to 'deaden' its motion by means of a liquid damper. This might be applied at the extremity of the axis of the vane produced below the roof, or at any points in that axis. A fan attached to the axis, and moving in a closely fitting vessel of oil or other suitable liquid, would afford almost any desired degree of stability.

Some steps were taken towards the construction of such a regulator, but I do not think it has ever been completed. Possibly the same method may have been experimented upon by others.

T. C. M.

Terre Haute, March 27.

A question for economists in regard to value.

Will not economists undertake to make some agreement as to what the meaning of the word 'value' is to be in scientific discussions? That a uniform meaning be given to this word is most essential to an intelligent discussion of an economic subject.

As an instance of the necessity of such an understanding, see the last number of *Science* ('Professor Marshall on the unit of value'). In that the professor evidently assumes that the market-price of commodities is their 'value.' Yet we all know that the price of a thing may be greater or less than its 'value' or worth. In order to establish a 'unit of value,' the professor proposes a plan whereby the variations of prices of commodities shall be averaged, and that plan implies that a dollar (money-unit) shall be established whose weight shall be increased or decreased from time to time as the average commodity price increases or decreases. All this is a matter of *money* and *price*, and not *value*. The real thing to be determined is what is *value*, and then a measure may be designed for it.

At present there is among economic writers a great confusion in the use of the word 'value.' Some, as Professor Marshall, use it as meaning price (market-price); some, comparative utility; some, exchange value; some, cost of production in terms of human labor; and some, "the average amount of socially requisite labor measured by time" involved in the production of the article. I hold that this last is the

best definition of value or worth, and that it should be adopted as the scientific meaning of the term.

At any rate, a discussion on this topic is most timely. The basic idea of the modern labor movement is the idea that workingmen do not get an *equivalent* (equal value) for what they produce. If scientific men are to take any hand in practical politics or applied sociology, this is the point where their work is most required at present.

E. LANGERFELD.

New York, March 26.

The destructive caterpillars of the squares of New York.

Since the importation into America of the quarrelsome, active, and noisy English sparrows, which have driven the quiet and brilliant birds of the south from the city gardens and parks, a new prolific horde, with fierce appetites, every year more extended, threatens to destroy our fresh and green shade-trees.

As early as 1882 the *New York evening telegram* sounded a note of alarm on this subject, to which we added another, but without effect. When nature threw off its summer mantle, and this ravaging army quietly took up its winter quarters, every thing seemed to be forgotten, and our modest communication no doubt went into the pigeon-hole of oblivion; nevertheless, we try again.

After three years' study of the devastating habits of caterpillars, we tried to engage the attention of the committees having charge of the city parks; but to no purpose, for in the summer of 1883 the enemy had greatly multiplied. After some years of neglect, it was too late to save from destruction the plants which had become insufficient to feed the successive broods of myriads of caterpillars. The new-comers soon got beyond the city limits; and once getting a foothold in the suburbs, science, the fruit of observation, could no longer keep within bounds the voracity of these unattackable hairy pests.

The damage of one year may be unlike that of the preceding or following; atmospheric changes may destroy multitudes; but the enemy is prolific, and will in a year increase ten, a hundred fold, and even more.

As the press of New York and even intelligent citizens may think that this enemy has disappeared, we raise a new cry of alarm, addressing ourselves to the learned societies of our adopted country, at the same time communicating the results of our studies to intelligent readers interested in the natural sciences. Our statements will be based on facts observed by us in New York, supported by the testimony of learned colleagues with whom we (myself and son) have corresponded for more than two years, during which we have studied the increasing ravages of this coquette with brilliant, silky, and variegated dress which science names the Orgyia caterpillar.

When the European sparrow was first introduced into the parks of New York, a caterpillar was there committing great depredations. Linnaeus called it the geometer: we call it looper, spanner, and canker-worm. The larva has six feet on the first three segments, and four on the last two, and as it progresses seems to measure the ground. The sparrows were very fond of this caterpillar, to a degree that their increasing numbers speedily exterminated it: for this they deserve our gratitude. It was different with the larvae of the Orgyia. Consequently we have thought it might be of interest to the public to say a little of what is known of the habits of the first as compared with the second equally destructive species. The first still exists in many private gardens in New York

Phalaenidae. — The butterflies which come from the larvae of the geometers almost all have the body slender, the thorax narrow, and wings proportionally wide; their flight being consequently more uneven and jerky, more unsteady, than that of the nocturnal species: the flight, in fact, is more like that of the diurnal ones, but is neither so strong nor of long duration, on account of the comparative weakness of the framework of the wings. They especially like serene and still evenings and nights. But there are to this characterization many exceptions. Some of the Phalaenian larvae have 12 legs, and some even 14; among the nocturnal species, again, some have 12 and others 14 legs; the general rule being 16 legs among the nocturnal, and 10 among Phalaenians. It is also a curious fact that the larvae of those with 16 legs loop in progressing, for some reason making no use of the intermediate legs.

Another kind of exception is that some Phalaenians which are nocturnal, a small number it is true, have a diurnal flight; that is to say, that certain species fly in full sunlight, gathering food on flowers in company with diurnal butterflies: so that the division into diurnal and nocturnal species is, in this respect, conventional. It is, however, true that day butterflies have almost always the antennae club-shaped, and come from larvae with 16 legs; while the Phalaenians, whose larvae have 10, 12, or 14 legs, have filiform or pectinated antennae.

There are in Europe some 600 Phalaenians, 700 nocturnal, and 400 diurnal butterflies; though it is probable that in hot climates the diurnal are more numerous than in the temperate. The Phalaenians, especially in cold regions, have usually sombre colors, gray or black, though there are many exceptions. In France there is a large and handsome green species, which is a common symbol on the tombs of children, probably on account of its delicate form and color. They hatch at all seasons of the year: there is even a group (Hyberniadae) which appears in December, January, and February. The Phalaenians may emerge from the pupa even below 50° F., while the others, and especially the diurnal species, require at least this temperature.

In Hibernia we find a singular fact. The females have either no wings, or semi-wings unfit for flight. As the pupa is generally in the earth, the female, on emerging, crawls up the nearest tree, where pairing takes place; the male bearing her to the top of the tree, and sometimes carrying her off in his flight. The females are small; and the males, much larger, deposit them in places proper for the support of the larvae, — buds of flowers, or masses of leaves, according to the species. There are in this group some veritable pests for man. The H. de foliaerio sometimes so destroys the leaves of forest-trees, that, unable to respire, they either die or partially wither. The H. brumata consumes every thing in the orchards, attacking the flowers of all kinds of fruit-trees.

It would be interesting, but impossible here, to speak of the habits of many of these butterflies, and to note their exceptional characters; but a single example must suffice. There is among the Phalae-

nians a group of about one hundred species, all with different habits, — the Eupithecia, studied for many years by M. Goossens of Paris, from whom these details are taken. The E. rectangularia, so named from the design of the upper wings, emerges from the pupa at Paris in April. After pairing, the female deposits an egg in the midst of the flower of an apple, pear, or quince tree. The egg, which is yellow, is well hidden in the heart of the flower, and is hatched in a few days. The larva, hardly visible to the naked eye, is of a rosy-white color, and begins its work by attaching one end of a thread to the top of a petal, and the other to the heart of the flower; by its traction the petal being bent down. The same is done with the five petals; and the larva is thus enclosed, protected from wind, rain, and parasites. It can with impunity devour the base of the flower and of the petals. The pollen of the male flower cannot fecundate the female flower, which is the one selected by the larva, and consequently there is no reproduction and no fruit. As the eggs have been widely scattered by the female's instinct, a few of these insects may render abortive the flowers of an orchard, or even of a region, without any reasonable explanation for the horticulturist. So many similar insects attack in this or other ways our fruit-trees, that in some places it is an astonishing event to see an apple on a tree.

While remembering that the European sparrows have done great service to New York by destroying the larvae of the geometers, or canker-worms, almost all of which are bare and smooth, it must be said that they are useless, and even injurious, in presence of the larvae of Orgyia. Sparrows, like most birds of the genus, do not like the hairy larvae, from the irritation they cause in the throat and stomach. One may frequently see poultry seize such larvae, kill them by beating them on the ground, and then leave them without eating them.

Bombycidae. — In this family belongs the larva which of late years has been so destructive in the parks and gardens of New York. For a long time we sought to discover its place of origin, how it arrived here, became acclimated, and multiplied to such an astonishing degree without meeting the parasite which destroys it. At first we thought it had been imported from France, where a species of the group, Orgyia antiqua, had been known in the Paris squares for several years, devouring trees and shrubs, and sometimes a pest among the rose-bushes. After having carefully compared it, with the aid of M. Goossens of Paris, it seemed to come very near to, if not to be, the O. vetusta, — a species common in California, which places its cocoons in the interstices of the bark of trees, the grooves of lamp-posts, cracks in wooden fences, and also between the hoops on wine-casks on the wharves. In the last way, the insect, which does not bear transportation well, might be carried even across the continent or the ocean. Without the necessity of this derivation, it has now been ascertained that the species is O. leucostigma Smith, which occurs in the neighborhood of Davenport, Io. (see Proceedings of the Academy of natural sciences, 1867-78, Davenport, Io., vol. i. p. 177). This may be found much nearer.

It is precisely at its youngest age that the life of the insect is best protected. An egg, according to Reaumur and others, will endure a cold of 50° below freezing, and the boiling-point of water in heat, without losing its vitality. In this age there being no means of defence or escape, a species would soon be destroyed without these natural means of resistance. After hatching, the larvae are dispersed, and conceal themselves in places resembling them in color, until the survival of the species is assured. Nature always furnishes efficient protection when most needed.

Before taking up the Orgyia larva, we wish to speak of a parasite which we discovered, — an inoffensive dipterous insect, all of whose metamorphoses we have studied, which would soon destroy the larvae, if the sparrows, in their turn, did not become the persistent and greedy devourers of said parasite.

At the two seasons of the year when the larva makes its appearance in New York, this dipterous insect is on the watch, and as it crawls along the ground deposits an egg in the midst of its hairy covering. Toward the end of winter or beginning of spring the dipterous larva is developed at the expense of the Orgyia pupa. Then, instead of a moth being hatched, appears an active fly with extended wings, large enough to be observed by the naked eye. Precisely at this moment the sparrows hunt them, devouring great numbers, which, if allowed to multiply by this strange manner of hatching, would soon much reduce the number of the Orgyia, if they did not completely destroy the species. Here comes in the reflection that the sparrows are now not only useless, but actually aid in the multiplication of the destructive Orgyia.

But not to completely ostracise these noisy and vivacious strangers from the land where, with so many of my countrymen, they have been so hospitably received, let them remain as long as the people care to protect them; inasmuch as, without disturbing them in their picturesque dwellings, there is a way of destroying the Orgyia, by an anodyne and easy process, doing no harm either to plants or animals, nor to the visitors of the beautiful parks of the city. Nothing is more disagreeable to the fair promenaders than to feel upon the neck, see suspended from their head-dress or hair, or crawling over their dresses, these little creatures, interesting to the scientific observer, but causing a shudder to them.

The larvae of Orgyia know well the laws of aerostation, and the use of the parachute. M. Capronnier of Belgium, a few years ago, in the month of October, made this singular observation on the method of their dispersion. It must be remembered that the females of Orgyia are wingless, — a character which distinguishes them from the genus Liparis, in which the females have wings. The question was asked how the Orgyia could gain access to an enclosure newly cultivated. M. Capronnier replied that he had seen the small larvae emerge from eggs laid in the cocoon of Orgyia. They made a thread from which they suspended themselves free in the air, when the wind carried off the larvae with the thread, no doubt to great distances, and they very soon disappeared. This mode of dispersion is similar to that observed in some spiders.

The genus Orgyia was established by Ochsenheimer, and belongs to the Bombycidae, or those whose larvae make cocoons from their own hairs, or particles of earth hardened by a salivary secretion, etc. The adults are of small size. The males, of rich colors usually, fly rapidly in full sunlight; the antennae wide, bipectinated, doubtless with an acute sense of smell, which guides them to the females. The last are five or six times as large as the males,

heavy, full of eggs, motionless, having not even an embryonic trace of wings. The larvae which are to become males, beside some differences in colors, are much smaller as pupae than those which are to become females. As soon as the perfect stage arrives, the males commence their flight, while the females simply emerge from their cocoon, on which they remain, attracting the males by an odor which they emit, inappreciable to our senses, but shown to exist by the fact that the males will enter an apartment in which a female is imprisoned in a tin or wooden box. The males move their antennae vigorously during flight, often bending them forward, and approach the windows. If these be closed, they go around the house in search of an entrance: they have even been known to descend the chimney.

Pairing is accomplished in a very rough manner. Among many Sphingidae the males approach gently, attract attention, departing and returning in circles, gradually diminishing, until union takes place; but in these the contact is rude, almost brutal, and the female, after the departure of the male, remains motionless, and begins to lay her eggs on the cocoon. O. antiqua, of France, lays its eggs near the cocoon, where they become attached by a secretion which covers them as they are laid. O. gonostigma lays her eggs near the cocoon, taking hairs from its body to make a bed for them, in alternate layers of hairs and eggs, till all are deposited, to the number of about three hundred. The New York species covers the eggs with a white viscid secretion, solidifying in the air, resembling the mucus of the snail and slug. The eggs are generally pretty, at first round, then indented at the top like a goblet or cup, sometimes with a rose-colored ring (in O. antiqua), sometimes of a porcelain-white tint (in O. vetusta).

The larvae escape from the egg by eating through the bottom, where the holes for fecundation are placed. They do not disperse themselves widely. As they live on trees and shrubs, are not large, and eat little individually, they may be numerous upon a single plant. Moreover, almost all are polyphagous, or will eat many different kinds of plants. In France, however, the O. ericaea lives only upon heaths, and the O. trigotephras on a species of oak.

Some species have several broods a year. The O. antiqua, in Paris, like the New York species, appears in June, and sometimes in October; others have only a single brood; but this cannot be made use of in classification or physiology. A given species may have but one brood in the north of Europe and America, and two in the south; and even in Paris and New York, when September is very warm, a second brood may appear, which would not occur in many other Lepidoptera. In captivity, also, the absence of cold nights changes the epochs of their appearance, besides favoring the development of a second brood.

Linnaeus says that the male of the Orgyia, knowing by instinct that the wingless female is powerless to move far, when he finds her on a wall or plant, flies away with her during pairing, and carries her to a place where the young may obtain food. This we have never seen, and never expect to, as the males are entirely too small and feeble to carry off the much greater bulk of the female. We need not say any thing here of the O. detrita, which resembles much the O. vetusta or leucostigma, and may be the same species. Le Metayer de Guichainville.

New York, March 22.

Fossils from Kicking Horse Pass.

I have to-day received the following very interesting communication from Professor Lapworth, on the result of an examination he has kindly made for the survey, of a collection of graptolites from the Rocky Mountains, in the vicinity of the Kicking Horse Pass.

Alfred R. C. Selwyn.

Geol. surv. Can., March 15.

I have recently examined the fossils collected by R. G. McConnell, geological survey of Canada (1886), from the dark, slaty shales of the Kicking Horse Pass, Rocky Mountains. There are few species in the fairly large collection, but the forms are generally well preserved, and the fauna represented is a distinctly typical one. The following are the species I have identified: —

(A) Family Dichograptidae.
  (1) Didymograptus, sp. nov., allied to Didymograptus enodus Lapworth from the Llandeilo beds of Abersiddy Bay, South Wales (see *Quart. journ. geol. soc.*, 1875, plate 35, figs. 1*a*, 1*b*).
(B) Family Glossograptidae.
  (2) Glossograptus ciliatus Emmons.
  (3) Glossograptus spinulosus Hall.
(C) Family Diplograptidae.
  (4) Cryptograptus tricornis Carr or C. marcidus Hall.
  (5) Diplograptus angustifolius Hall.
  (6) Diplograptus rugosus Emmons.
  (7) Climacograptus coelatus Lapworth.

There are also a few other forms, doubtful.

Species of Phyllograptus or Lasiograptus, etc.

The fact that these graptolites have been obtained from the distant region of the Rocky Mountains gives them an especial interest, as few graptolites have hitherto been noticed from that region. The only notice of graptolites from the western states known to me is that given by Dr. Charles White in vol. iv. ('Palaeontology') of the 'Report of the geological survey of the hundredth meridian.' Four forms are described by him (*loc. cit.*, pp. 9, 10, *et seq.*) as having been obtained from some beds of partially metamorphosed shale five miles north of Belmont, Nev. No fossils were found associated with them that might assist in the determination of their exact age; and they were provisionally referred to the geological date of the Utica slate of New York state.

These graptolites from the Kicking Horse Pass, under notice, may also be referred to the age of the Utica slate, or at any rate to the Trenton. In the Utica fauna of the United States and Canada the association of forms is just such as occurs in the Llandeilo (lower and middle) of Britain, and some of the forms are common to both sides of the Atlantic.

. . . . . .

It is curious that none of the family of the Dicranograptidae (Dicranograptus and Dicellograptus) are represented in this little collection. It is just possible that it may therefore be somewhat older than the typical Norman's Kiln beds, where the Dicranograptidae are exceedingly abundant. Neither have we any of the peculiar genera of the Leptograptidae (Coenograptus and Leptograptus, etc.) so prevalent in the Norman's Kiln horizon everywhere. Thus it is by no means unlikely, judging from the evidences at present at our disposal, that the fauna of the shales of the Kicking Horse Pass come from strata answering broadly to the British lower Llandeilo: they are distinctly newer than the Point Levis beds, and belong to the second Ordovician fauna, but in all probability to the oldest zones of that fauna.

Chas. Lapworth.

Mason college, Birmingham, March 7.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 1, 1887.

THE AMERICAN WHALE-FISHERY, 1877-1886.

THE American whale-fishery reached its flood-tide of prosperity about the middle of the present century. In 1846 the fleet numbered 722 vessels, valued, with outfits, at nearly $20,000,000. The most valuable catchings were in 1854, when the oil and bone secured were worth $10,766,521. The largest annual yield of sperm-oil was in 1837, 5,329,138 gallons, averaging $1.24¾ per gallon; of whale-oil, in 1851, 10,347,214 gallons, averaging 45$\frac{5}{16}$ cents per gallon; and of whalebone, in 1853, 5,652,300 pounds, at 34½ cents (gold) per pound.

In 1877 the whaling-fleet numbered 163 vessels, hailing from the following ports: New Bedford, Mass., 118 vessels; Provincetown, Mass., 21; Boston, 6; Edgartown, Dartmouth, Fairhaven, Marion, and Westport, Mass., 12; New London, Conn., 3; San Francisco, 2.

In 1886 the fleet cruising in the North Pacific and Arctic had very largely transferred its headquarters and ownership from New Bedford to San Francisco. The hailing-ports of the fleet during this year, numbering 124 vessels in all, were as follows: New Bedford, 77 vessels; Provincetown, 12; Boston, 3; Edgartown and Marion, 4; New London and Stonington, 6; San Francisco, 22.

The distribution of the fleet in 1886 was as follows: 48 vessels, mostly schooners, cruising in the North and South Atlantic; 39 vessels, the largest and best in the fleet, cruising in the North Pacific, Bering Sea, the Arctic north of Bering Strait, and in the Japan and Okhotsk seas, pursuing the bowhead and the Pacific right whale; 2 vessels in Hudson Bay in search of the bowhead; 20 vessels cruising, chiefly for sperm whales, in the South Pacific and Indian oceans. Thirteen vessels were detained at home ports throughout the year, leaving the active fleet only 111 sail.

The business is carried on by forty-nine firms and general agents, with headquarters chiefly at New Bedford and San Francisco.

The following tables show the condition of the industry during the last decade. There has been a steady decrease in the number and tonnage of the vessels. The annual yield of sperm-oil has greatly decreased. The yield of whale-oil, which includes oil of walrus and of all cetaceans other than sperm whales, varied greatly from year to year. The value of sperm-oil from 1877 to 1886 averaged 92 cents per gallon; whale-oil, 47½ cents per gallon; and whalebone, $2.44 per pound.

Number and tonnage of vessels, and value of oil and bone.

Year.	Number of vessels.	Tonnage of vessels.	Value of catchings.
1877	163	40,593	$2,309,569
1878	179	39,700	2,232,029
1879	178	40,028	2,056,069
1880	173	38,408	2,659,725
1881	177	38,551	1,926,620
1882	161	36,802	1,861,779
1883	147	34,000	1,891,716
1884	144	33,119	2,542,614
1885	133	31,207	2,456,064
1886	124	29,118	1,792,657

Number of barrels of oil, and pounds of whalebone taken.

Year.	Whale-oil.	Sperm-oil.	Whalebone.
1877	27,191	41,119	160,220
1878	33,778	43,508	207,259
1879	23,334	41,308	286,280
1880	34,776	37,614	464,028
1881	31,650	30,600	368,000
1882	23,371	29,884	271,999
1883	24,170	24,595	254,037
1884	24,670	22,670	426,968
1885	41,586	24,203	463,990
1886	27,249	23,312	352,490

The two principal branches of the industry are the sperm-whale and the right-whale fisheries. Vessels engaged in sperm-whaling are sometimes employed 'between seasons' in the capture of humpback whales. The right-whalers take the bowhead or polar whale and the ordinary right whale of temperate waters. They also capture walrus for the oil and ivory.

About one half the tonnage of the fleet, including most of the smaller vessels, is employed in sperm-whaling, and the other half in right-whaling. More than fifty per cent of the sperm-oil is taken in the Atlantic Ocean, and about three-fourths of the whale-oil comes from the Arctic.

Sperm whales are very widely distributed in temperate and tropical waters. They have been taken as far south as the 50th parallel of latitude in the Atlantic and Pacific, and as far north as latitude 56° 12′ in the North Pacific. They are generally taken in deep water, though sometimes captured in the more shallow waters at the edge of the great ocean-banks. They are smaller within thirty degrees north and south of the equator than in higher latitudes. The fishing-grounds for sperm whales are widely separated. In the North Atlantic good sperm-whaling has been found in the Caribbean Sea, in the Gulf of Mexico, and in various places about the West Indies, the Bahamas, and the Azore Islands. Among the most important regions are the 'Charleston ground,' in latitude 29° to 32° north, and longitude 74° to 77° west; and the 'Hatteras ground,' along the edge of the Gulf Stream, in the latitude of Cape Hatteras. Other resorts are the 'Two forties' and 'Two thirty-sixes,' situated at the crossings of the 36th and 40th parallels and meridians. There have been important grounds from latitude 48° to 54° north, and longitude 23° to 32° west.

In the South Atlantic, sperm whales are now taken chiefly along the African coast and between the coast and St. Helena. Very profitable whaling was formerly found along the South American coast.

The South Pacific grounds for sperm whales are off the Chilian coast, extending from latitude 35° to 46° south, and from the coast 200 miles off shore. North of here are the 'Archer ground,' the 'Callao ground,' and other resorts. Throughout the South Pacific there were formerly many other extensive and profitable cruising-grounds; but they are now nearly all abandoned, not entirely because of the scarcity of whales, but because of the low price of sperm-oil and the great expense attendant upon the long voyages to distant seas. A few vessels still cruise in the vicinity of New Zealand and Australia, and in some seasons make good voyages.

In the North Pacific, also, sperm whales were formerly taken on various grounds along the coast of Lower California, and on the once famous 'Japan ground,' extending across the ocean along the 30th parallel, and especially between latitude 25° and 40° north, and longitude 140° to 180° east. For several years no vessels have been fitted for sperm-whaling in those waters; though Arctic vessels on their way north, after their spring cruising, have reported these whales in abundance.

The Indian Ocean was once the scene of an extensive fishery for sperm as well as right whales, but very few vessels have gone there during the last ten years. In 1880 there was no American whaling-vessel in that ocean; in 1886 two vessels went there, with fair success. Sperm whales were found principally off Port Dauphin, around Madagascar, about Mauritius, Bourbon, and Roderique islands, the Amirante group, off Zanzibar, and elsewhere along the African coast to the Red Sea.

Right whales (Eubalaena) are found as far north as latitude 61° 30′ at the mouth of Hudson Strait, and south to the Antarctic Ocean, though they are not common in tropical waters. These are also called 'black whales,' to distinguish them from the bowhead or polar whale (Balaena mysticetus), which by English whalers, and often by others, is confounded with the right whale. The bowhead is an ice whale, found only in Arctic regions, while the other species inhabit temperate waters.

The principal resorts of the right whale east of America are in the South Atlantic, while in the Pacific they are about equally abundant both north and south of the tropics. These whales were formerly taken along the New England coast, but they are now only occasionally captured in the North Atlantic. During the winter months whalers find them on the Hatteras ground and in the Gulf of Mexico and Caribbean Sea, and a few vessels have met with indifferent success in searching for them along the west coast of Africa between latitude 15° and 23° north.

In the South Atlantic they are sought for around the Tristan Islands and along the South American coast, where they were once very abundant.

The Indian Ocean was once an important right-whaling ground, but is now practically abandoned.

In the South Pacific, right whales are taken from September to January, off the coast of Chili, on the grounds from latitude 42° to 47° south, and longitude 75° to 80° west, and in the spring farther north and nearer the coast.

The North Pacific right-whale grounds were once famous, and were cruised over by upwards of two hundred American vessels. The principal resorts were the 'North-west coast' or 'Kadiak ground,' off the Alaska Peninsula, and in the Japan and Okhotsk seas. After the discovery of the whaling-grounds in the Arctic, the lower latitudes were gradually abandoned. A few vessels, however, have within a few years past again resorted to the Kadiak, the Okhotsk, and the Japan grounds.

Humpback whales are found within the parallels of 60° north and 70° south. They are taken chiefly in shallow water within certain bays and along the coast. The island of Trinidad and Gulf of Para, also the Cape Verde Islands, and the African coast from 3° to 7° south latitude, and about the West Indies, are the principal grounds in the Atlantic. Some years these whales are quite abundant along the New England coast and on the off-shore fishing-banks.

In the Pacific these whales are found along the South American coast, particularly in the Bay of Panama and in the Gulf of Guayaquil, and along the Californian coast. They are also found as far north as the Aleutian Islands, where the natives capture them.

The California gray whale, or devil-fish (Rhachianectes glaucus), is found only in the North Pacific, and is an object of pursuit by the shore stations established along that coast.

Finback and sulphur-bottom whales are quite universally distributed; but, their blubber yielding comparatively little oil, they are not often captured except by shore parties along the Californian coast, at Cape Cod in New England, on the northern coast of Norway, and at Iceland.

Bowhead whales, as stated above, are confined to icy waters. The Atlantic-Arctic fishing-grounds are in Davis Strait, Cumberland Inlet, and Hudson Bay. American vessels formerly cruised as far north as Pond's Bay, in about latitude 73°, but they now seldom go beyond latitude 65°. Scotch whaling-steamers, however, cruise as far north as 75°, their northern range being limited only by dangers from ice.

The Pacific-Arctic resorts of the bowhead are in Bering Sea and north of Bering Strait. About three-fourths of the whale-oil and nearly all the whalebone landed by American whaling-vessels is taken by the North Pacific fleet, so called, cruising north of Bering Strait and in the Okhotsk Sea. The vessels in this fishery are the largest and best equipped in the whaling-service. In 1879 or 1880, steamers were first used in this fishery, and now about one-fourth of the fleet are of this class. They can push their way with less danger than sailing-vessels amid the ice-floes, and, as a rule, thereby secure a greater catch. The Arctic vessels have their headquarters at San Francisco. They leave for the north about March 1, in season to meet the ice in Bering Sea, and to push gradually northward with it. Usually about May 1 to 10 a few whales are overtaken on their northward migrations, and as fast as the ice permits, the vessels crowd their way in pursuit. Until about June 1 the fleet cruises along the Siberian coast, capturing as many whales as possible. Those which are secured form only the 'fag-end' of the 'herd,' most of the whales having moved northward before the vessels could overtake them. As soon as the ice allows, the vessels push their way through the Strait, ever alert to catch the whales which are hurrying to the far north. From the middle of June till the latter part of July few whales are taken. During this time, while waiting for the return of the bowheads, the whalers devote their time to capturing walrus, which are valuable for both ivory and oil. About the beginning of August the fleet moves eastward and northward to Point Barrow and beyond, capturing whales wherever they can be found, though but very few are seen until the southward migration begins, in the latter part of the month. From this time till the latter part of September or early in October, when the season closes, there is great excitement and eagerness to secure as many whales as possible.

The early departure of the animals to inaccessible regions among the ice, and the anxious weeks spent in awaiting their return, make this ground one of the most exciting regions that whalemen can find, and the surroundings are of more than usual interest. Nothing can exceed the daring and pluck of the whalemen in their endeavors to search out and capture their prey. Forgetful of surrounding dangers, they pursue the spouting animal far up among the ice-floes; and many a vessel has been crushed to pieces by the ice as she was tracking out a whale. Anxious to secure full fares, they remain amid the freezing waters until early winter stares them in the face, when they plough their way homeward. Several disasters have overtaken the fleet in their zeal to catch the whale, as in 1871, when thirty-five noble craft were left at anchor in sight of certain destruction; the crews, after arduous labor, saving themselves with their boats.

Not always are the whalemen thus fortunate in escaping with their lives. In 1879 two vessels became separated from the fleet, and were never after heard from. Nearly every year one or more vessels are caught in the ice and ground to splinters. In Hudson Bay and Cumberland Inlet, also, the vessels are exposed to dangers from ice. From 1846 to 1880, eighteen vessels were wrecked in those waters. The fleet is not as large as that cruising north of Bering Strait, nor are the vessels generally so large and so well equipped. Several vessels have passed the winter 'locked in the ice,' in Hudson Bay or in Cumberland Inlet, and have thereby taken advantage of the early and late weeks of the whaling-season, besides securing bear, musk-ox, and seal-skins during the winter months.

Year.	Number of vessels.	Barrels of oil.	Pounds of whalebone.	Pounds of walrus ivory.
1877	19	17,530	153,800	74,000
1878	17	13,080	114,200	30,000
1879	21	18,800	200,500	32,900
1880	19	26,700	409,000	15,300
1881	23	24,740	387,000	15,400
1882	32	22,975	360,500	17,800
1883	38	10,155	159,400	23,100
1884	39	20,450	318,700	5,421
1885	40	24,844	451,068	6,564
1886	44	20,307	332,931	5,273

The foregoing table shows the extent of the Pacific-Arctic fishery from 1877 to 1886. The number of whales secured each year varies greatly. In 1880, 265 were caught; in 1885, 222; and in 1886, only 153. The 'whale' oil includes also oil of walrus.

A. HOWARD CLARK.

ICE AND ICEBERGS.

IN a paper read before the Royal society of Canada (May 27, 1886), 'On some points in reference to ice phenomena,' Dr. Robert Bell discusses various observations on the formation of ice and its action on the land. The rapid disappearance of icebergs after they have passed the banks of Newfoundland, he ascribes to the difference in temperature of the Gulf Stream and the interior of the berg, which is probably much colder than 0° C. He supposes that the rapid increase of the temperature of the water causes the ice to crack; and this process, once started, would rapidly continue as the colder parts of the interior come in contact with the water. An experiment made at Ottawa proved that ice, on coming in contact with warm water, really cracks. Though the difference in temperature may take an active part in fracturing icebergs, some other facts ought to be investigated before it is possible to decide on this question. The icebergs of the Labrador current show, even while in Baffin Bay, many signs of decay. The most remarkable ones are the deep grooves hollowed out by the waves breaking at the foot of the icy cliffs. The depth of these excavations and the amount of *débris* scattered around the berg prove the efficacy of the waves in breaking up the berg. However, the greater part of the year the bergs are embedded in pack-ice, and protected from the action of the swell. This continues as far as the Labrador coast. As soon as the berg reaches the southern end of the pack-ice, the breakers formed by the Atlantic swell will undermine its cliffs, the *débris* furthering their action. The history of icebergs may well be observed in Baffin Bay. The greater number are flat, and shaped like a table, having a flat top and vertical edges. They attain a size of from twenty-five to thirty square miles, and are about four hundred feet thick, their height above the water being fifty feet. These masses of ice, on striking a rock or a shoal, are broken up into small pieces, all of which have vertical edges. A very few of these are tilted, the horizontal top becoming inclined and partially submerged. Thus some parts of the berg attain a far greater height than they had before the tilting, and it is probably thus that the high and pointed icebergs originate. Flat bergs are very stable, while pointed ones show signs of frequent tilting and capsizing. Grooves which were excavated by the swell may be seen in all parts of the berg, some of them even running vertically. Sometimes many parallel grooves prove that large pieces of the unsubmerged part of the berg broke off, and that it gradually emerged from the ocean. Grooves diverging from one edge are of frequent occurrence, and were caused by the lifting of one side of the berg. It would be of great importance to know whether the tilting has any influence upon the direction of the cracks and fissures. These are always vertical while the bergs are in their original position. There are no observations which would enable us to decide whether the same direction is maintained after the tilting, which would be of eminent influence on the breaking-up of the iceberg. If, after the tilting has occurred, inclined faces would originate, this would materially contribute to a rapid destruction. As even small pieces of the large bergs have vertical edges, their direction is probably due to the structure of the ice, and will be maintained in any position the ice may have.

Bell remarks that the amount of rocky and earthy material carried from north to south by bergs is not very large. Field-ice, on the other hand, particularly such as is formed in shallow bays with high tides, and near the land, always carries great quantities of mud and stones, which are carried upon it by the wind or avalanches. We do not think that any amount of material is carried upon the ice by torrents formed by the melting of snow, as Bell supposes. The ice always contains some salt, and, as the melting-point of the fresh water coming from the land is higher than that of the ice, the latter is rapidly wasting at the mouths of the rivers.

In regard to the formation of Frazil (anchor) ice,

Bell is in favor of the hypothesis of Dr. Sterry Hunt, who regards it as due to terrestrial radiation, and analogous to the formation of hoar-frost on the surface of the ground in clear weather. A similar opinion was held by Arago, but this theory does not explain all the phenomena; and the views of Zschokke, that the anchor-ice is formed on the surface and carried to the bottom by the current, seem to agree better with the facts. C. W. Weber and J. Rae agree with this theory. It is doubtful whether water is so diathermal for dark rays that the radiation should have any effect on the formation of anchor-ice.

Of great interest are Bell's remarks and observations on the long fissures which remain open throughout the winter. He proves that the changes of temperature have no influence upon their width. They form every winter in the same situations, and generally between the extremities of points on opposite sides of the water. He considers it probable that the progressive lowering of the water going on during the winter produces a tension on such places sufficient to keep the fissures open.

Finally, Bell explains the remarkable rings and dikes of bowlders caused by the action of the ice. In ponds which freeze to the bottom, bowlders are incorporated in the ice. As the ice is evaporating at its surface, while accessions of water lift the ice, the bowlders are raised and gradually carried toward the periphery. On large lakes the drifting ice is pressed against the shores, and thus forms dikes of bowlders.

MÜLLER'S SCIENCE OF LANGUAGE.

THE appearance of the concluding part of Dr. Müller's great work on linguistic science, which has occupied ten years in its publication and of course a much longer time in its preparation, affords a good opportunity for considering this important contribution to science as a whole. In speaking of it as concluded, however, the term must be understood as applying to the original plan, which contemplated only three volumes. In this sense, the author regards his work as completed. But, as we learn from the preface to the latest portion, he purposes adding two supplementary volumes, one of which will be occupied with the analytic and the so-called 'mixed languages,' as well as with new idioms, extinct and living, of undetermined position, while the other will comprise the materials which have accumulated during the past ten years.

Like the other inductive sciences, — and perhaps even more than the majority of them, — comparative philology has been a rapidly growing science. No better evidence of this fact can be found than in the comparison, to which the author himself invites us, of his work with that of his noted predecessors, Professors Adelung and Vater, whose well-known 'Mithridates' presented the first general survey of languages ever attempted on a scientific plan. That great work, of which the last volume appeared in 1817, is justly deemed a monument of erudition and laborious research. The authors undertook to give an account of all known languages, with (wherever practicable) the Lord's Prayer as a specimen of each, translated and carefully analyzed. The work was as well accomplished as was possible at the time. But the necessary materials were to a large extent lacking, and the principles of the science were imperfectly understood. During the sixty years which have since elapsed, the progress of research has not only added largely to the data, but has developed many laws of the science, and in a great measure revolutionized its character. Exploring expeditions, missionary labors, and the study of ancient monuments have more than doubled the number of known idioms. At the same time, the profound investigations of many eminent scholars, in Europe and America, have elucidated the principles which lie, or seem to lie, at the foundation of the science. Some qualification is necessary in this statement, for in the science of language, as in other sciences, new discoveries are constantly appearing, which alter materially the aspect of what was deemed to be established truth. Not the less, however, is it certain that a vast progress has been made since the time of Adelung and Vater. Some able and practised hand was needed to gather up the immense mass of scattered material, and to frame a structure which should represent the present condition of the science, and make a solid platform on which other inquirers might safely build. No one, certainly, could be better fitted for this office, by experience and talent, than the distinguished scholar to whom we owe the linguistic portion of the history of the Novara expedition, and the well-known 'Algemeine Ethnographie,' which has long been a standard work.

In the brief preface to his first volume, Dr. Müller remarks that his work is designed specially for the use of academic lecturers and for students who desire the means of self-instruction. He has therefore purposely avoided the more popular and discursive method of books intended merely for general reading, and has adopted in preference the concise and systematic form of treatises devoted to the exact sciences. Throughout the greater portion of his work he has adhered strictly

Grundriss der sprachwissenschaft. Von DR. FRIEDRICH MULLER. Vienna, Alfred Holder; London, Trubner. 8°.

to this scientific method, which, as he justly considers, can alone give to such a work a permanent value. In the introduction, however, which occupies about a third part of the first volume, he has allowed himself more freedom, and has entered into many disquisitions which will interest the general reader, and will doubtless evoke much discussion and some dissent. He treats of the aim and limits of linguistic science; of the relation of speech to thought; of the origin of language, including the great question of the unity or plurality of beginnings; of the development of speech; of its material and formative parts; of the proofs of kinship among languages; of their classification, according to the various systems which have been proposed by philologists; of the elements of speech, — the root, the word, the sentence; of articulate sounds (phonology); of the expression of thought by writing, and of the influence of writing on the development of language. This list of topics is much abridged, and gives only an imperfect idea of the many subjects on which the author touches in this important introduction, in which he has condensed the conclusions of long-continued study and profound analysis.

In his classification he has sought to combine the ethnological and philological methods, and thus to link his earlier 'General ethnography' with the present work. The attempt was a natural one, but cannot be said to be altogether successful; and it is easy to see that the author himself, whose candor throughout is transparent, was finally not altogether satisfied with it. In the classification of races he selects (as in his 'Ethnography') the hair as the best criterion. He divides all mankind primarily into two classes, — the 'woolly-haired' (*ulotrichi*) and the 'smooth-haired' (*lissotrichi*). Each of these classes is again subdivided into two divisions. The woolly-haired class comprises the 'tuft-haired' (*lophocomi*) and the 'fleecy-haired' (*eriocomi*); while the smooth-haired races comprehend the 'straight-haired' (*euthycomi*) and the 'wavy-haired' (*euplocomi*). Other high authorities, including St. Hilaire, Bory de St. Vincent, and Huxley, have adopted the hair as the best primary characteristic for distinguishing the races. But while the epithets drawn from it are excellent descriptive terms, they are found in practice, like those derived from the shades of color and the shape of the head, to be far too wavering and uncertain to serve the purposes of a true scientific classification. Such is the conclusion of Prichard, Peschel, Quatrefages, Wilson, and other able ethnologists who have tested these methods.

To this opinion Dr. Müller's own matured views plainly tend. Though he formally preserves throughout his work — evidently for the reason that has been suggested — the four classes distinguished by the hair, he practically deserts this classification for that which his studies and philosophical insight have convinced him to be the only satisfactory and proper one,—at least for a philological treatise,—namely, the genealogical classification, based on the distinction of linguistic stocks. These stocks are, in fact, in comparative philology, what the elementary substances are in chemistry, — the sole and sufficient ground of a true scientific classification. The question of the origin of these stocks, or linguistic families, is too extensive and too much contested to be here considered; but that their distinction and determination constitute the primary element and foundation of linguistic science is a definite conclusion, for which the high authority of Dr. Müller may now be claimed.

The main body of the work consists of careful analyses of the phonetic and grammatical systems of all the languages whose sounds and grammar are known. In most instances — and, in fact, wherever compositions in the language are found — specimens of the text are given, with interlinear translations, and with annotations explaining every grammatical peculiarity. Such translations are, of course, the best test of the author's knowledge of the language. The labor required to master so completely the intricacies and peculiarities of this large number of idioms — from the monosyllabic Chinese and Anamese, with their variety of tones and positions, to the multitudinous inflections of American tongues — must have been enormous; nor would mere industry have been sufficient, without large experience, and what may fairly be termed linguistic genius. The first volume comprises the languages of the woolly-haired races, and is devoted almost entirely to the African tongues. The single exception is the Mafŏr language, spoken on the northwest coast of New Guinea. The Mafŏr people are not more woolly-haired than many other tribes of Melanesia. But as the latter speak 'mixed languages,' mainly of the Malaisian type, they are relegated to the 'Malayan race,' which is included among the smooth-haired races. Thus the classification by the hair breaks down on its first application; and we cannot be surprised that the author, hampered at the outset by his earlier ethnological theories, is glad, as his work proceeds, to escape from them, and restrict himself entirely to the genealogical classification.

The second volume opens with an interesting description and comparison of the very peculiar and in some respects highly organized Australian languages, which are shown conclusively to be-

long to a single stock, and not to be allied either to the Malayan or the Dravidian tongues, to which some authorities have sought to refer them. The languages of the 'hyperborean races,' extending along the arctic coasts, from the Yeniseean tribes to the Chukchi and the Eskimo, lead naturally to the proper American idioms. The discussion of these idioms must be deemed the least satisfactory portion of the work, not from any failure in the author's research or accuracy, but from the impossibility of condensing his materials into the limited space allowed for them. The linguistic stocks of this continent are at least twice as numerous as those of all the rest of the world. Their grammatical characteristics vary widely, and are of the highest interest. As Prof. Max Müller has well pointed out, these languages "can tell us quite as much of the growth of the human mind as Chinese, or Hebrew, or Sanscrit." Some of the stocks or families — as, for example, the Algonkin, the Dakota, and the Maya — comprise many distinct languages, which have been carefully studied and compared by some of the ablest philologists of Europe and America. In purely scientific value, apart from merely extraneous grounds of interest, the Algonkin family far surpasses the Hamito-Semitic stock. Yet while the latter occupies two hundred pages, the former is restricted to thirteen. It is as though, in a treatise on zoölogy, eighteen pages were given to the horse, as being a biblical animal, and only one page to the elephant. It must be admitted that in the present condition of linguistic science this discrepancy could not well have been avoided without making the work unwieldy and unsalable; and it is fair to add that the descriptions of the American languages, so far as they extend, are for the most part remarkable exhibitions of analytic skill.

A most admirable account is given of the great Malaisian family, which occupies, with the exception of the Australian and some Papuan tongues, the vast island world from Madagascar to Hawaii. This is followed by the languages of the 'North Asiatic' or Mongolian race, extending from Lapland and Hungary to Japan and the Indo-Chinese peninsula. The Nubian or smooth-haired African race succeeds, followed by the primitive languages of Hindostan, composing the Dravidian family. The greater portion of the third volume is occupied with the languages of the so-called 'Mediterranean race.' This is a purely geographical designation, including populations so widely distinct in physical traits and in language as the Indo-Europeans, the Hamito-Semitic nations, the Caucasian tribes, and the Basques. To these languages, which were the first to attract the attention of philologists, the author has devoted special care. The perplexing variety of Caucasian tongues is reduced by him to two, or at the most three, families. The curious and elaborate inflections of the Basque are analyzed and set forth with remarkable clearness. Those students of language who are accustomed — as too many are — to regard the whole of philological science as summed up in the two families of the Indo-European and the Hamito-Semitic stocks, will here find an example of an indefatigable and large-minded scholar, who can equal if not surpass them in their special studies, while his wider view embraces, as that of every thorough philologist should do, a knowledge of the chief characteristics of all the other families.

The work lacks an index, which will doubtless be furnished with the supplementary volumes. There is another and a much more important deficiency, which we may hope will be supplied in this forthcoming portion. In his survey of languages, the author has restricted himself almost entirely to idioms of whose grammar something is known. Those tongues of which we possess merely vocabularies are to him as though they did not exist. He does not even condescend to name them. In his view, the life of a language is in its grammatical forms; and only by the comparison of such forms can we be made certain that two languages are, or are not, akin. The first of these propositions is unquestionably true; the other is opposed to much evidence and to the author's own example. Gallatin's great work, the 'Synopsis of Indian languages,' owes most of its value to its comparative vocabularies; and his classification, based mainly on these vocabularies, has proved substantially correct. It is purely by lexical comparison that Dr. Müller has been able to establish the unity of origin of all the Australian tongues. No doubt this method has been greatly abused by incompetent writers. It needs to be applied, like all other tests, with scientific knowledge and caution; but, when so applied, it will be found entirely conclusive. Employing this method, the author will be able to give us, for the first time in the history of philological science, a nearly complete list of linguistic stocks, which, instead of the 'one hundred' mentioned in his introduction (p. 77), will probably be found to number nearly three hundred; and he will thus at length place this science on a truly philosophical basis. If to this he would add a series of language-maps, similar to those of which Mr. Cust, in his volume on the 'Modern languages of the East Indies,' has given us admirable examples, his work would be completed in a manner which would leave little to be desired. Even without these additions, the

three volumes, as they stand, form a compendium of the greatest value, indispensable to all who are engaged in any department of linguistic study.

H. HALE.

PROFESSOR GAGE of Cornell university has recently issued a pamphlet consisting of notes on microscopical methods for the use of laboratory students in the anatomical department of that institution. They are designed to accompany the notes on histological methods which were published last year, and to give only the main facts and principles relating to the microscope and to its manipulation, which seem indispensable for the successful study of elementary histology. In these notes the microscope and its parts are described, and advice given as to its care, and also the care of the eyes, which are apt to suffer unless special precautions are taken to protect them. Professor Gage advises that both eyes be kept open, and the labor divided between the two eyes, using one eye for observing the image a while, and then the other. He recommends the use of an eye-screen made by pasting black velveteen on bristol-board. The body of the microscope is received in a hole cut in the middle of the length of the screen and nearer to one side. The eye which is not in use looks at the black surface, without any strain or injurious effect. The micrometer and its use are made clear, and a description given of the camera lucida and the methods of drawing the objects seen in the field of the microscope. The differences between adjustable and non-adjustable objectives, and their advantages and disadvantages, are concisely treated, as are also immersion objectives, and Zeiss' new apochromatic objectives. This name has been given to his objectives made of new kinds of glass. They are made adjustable and non-adjustable, dry, and for water and homogeneous immersion liquids. Altogether, Professor Gage is to be congratulated on having put a large amount of valuable information into a very small space, and that, too, without having sacrificed clearness of description. The figures, eleven in number, aid very materially in elucidating the text.

— Prof. John A. Ryder of the Biological department of the University of Pennsylvania has recently had a new microtome constructed. It cuts serial sections in ribbons, and is very compact, occupying a space of only eight inches by four. The sections produced are cut flat, and are not parts of a hollow cylinder. The thickness to be cut can be adjusted by a simple device, and ranges from $\frac{1}{10000}$ of an inch or .0025 mm. up to $\frac{1}{400}$ of an inch or .0625 mm. The knife, an ordinary razor, admits of being placed at any angle, as in a sledge microtome. The successive sections are cut as rapidly as the operator can move his right hand up and down through a distance of three inches. This new instrument was devised in order to provide a simple, compact tool, adapted to class-work, where many sections are required, and for embryological, histological, pathological, and botanical research, at far less cost than that of the best sledge microtomes, and, though constructed very differently from the latter, is equally accurate. Recently great improvements have been added, so that it can be used as a rapidly cutting, freezing microtome, or in cutting celloidin sections. With this new device, an object several inches in length may be embedded entire, as a single block, and cut up into a continuous series of sections by the ribbon method. Cutting a large block into a series of sections in this way is not possible with any other microtome yet devised. The range of capability of this new aid to research is therefore very great, and will doubtless be appreciated by teachers who wish to supply their pupils with an abundance of illustrative material, with a device fully three times as rapid in action as the Thoma made by Yung, and with all its capabilities for adjusting the knife and block. It is admitted by several competent histologists, who have examined it, to be the most practical instrument yet devised.

— Prof. J. Vilanova y Piera, of the University of Madrid, who has undertaken to edit a polyglot dictionary of geological and geographical terms, has invited Dr. John C. Branner, professor of geology in the University of Indiana, to take charge of the Portuguese part of that work. Besides the usual studies of the language, Dr. Branner has acquired a practical acquaintance with the Portuguese during two visits to Portugal and a residence of nearly eight years in Brazil, where he was assistant geologist upon the Imperial geological survey. In the preface to the Spanish part of the polyglot dictionary, Professor Vilanova y Piera says that such a work was first suggested to him by American geologists at a meeting of the International congress of geologists.

— The U.S. hydrographic office has published a complete list of the charts, plans, and sailing-directions that had been published up to the end of 1886. The catalogue will be a valuable book of reference to students of American geography. The supplements to the sailing-directions, which were issued in December, 1886, contain a collection of all the additional information which has from time to time appeared in U.S. 'Hydrographic notices' and 'Notices to mariners.'